REMARKS

The amendments to the specification correct minor errors and clarify the language. No new matter is believed to be added to the application by this Amendment.

Status of the Claims

Claims 1-12 are pending in the application and stand rejected. The amendments to the claims clarify their language without reducing their scope.

Objections to the Drawings

The Examiner objects to the drawings as not containing all of the features recited in the claims.

However, the overhang or taper angle can be readily discerned in Figures 4 and 5. Also, a person having ordinary skill in the art would recognize that the taper angle would be measured from a top surface of the electrode line.

Regarding claims 6 and 12, claim 6 has been amended to recite "a side portion of the second metal layer is less etched than that of the first and third metal layers" and claim 12 has been amended to recite "a side portion of the second metal layer protrudes beyond side portions of the first and third metal layers." These limitations are also clearly apparent from Figures 4 and 5.

As a result, Applicant believes that the drawing figures show each and every limitation of the instant claims, and there is no need to amend the drawings.

Objections to the Specification

The Examiner objects to the title as not being descriptive. A new title has been provided that is descriptive of the invention being claimed.

The Examiner objects to the specification as not accurately describing the relative etching of the metal layers, as is reflected in claims 6 and 12. The specification as amended clearly sets forth the relative etching of the metal layers.

Also, the Examiner objects to the specification as not clearly setting forth the taper angle of more than 45°. However, this taper angle can be readily discerned from Figures 4 and 5 where the metal pattern forms a trapezoidal configuration. That is, a person having ordinary skill would know that the angle is measured from a top surface of the electrode line shown by, for example, reference numeral 51 in Figure 4A.

Accordingly, the specification as amended is fully descriptive.

Rejection Under 35 U.S.C. 112, Second Paragraph

Claims 1-12 are rejected under 35 U.S.C. 112, second paragraph as being indefinite. Applicant traverses.

The Examiner considers a taper angle of more than 45° to be indefinite because no upper limit is set. However, the maximum taper angle is implicit in this limitation because when the taper angle becomes sufficiently great, the surface becomes flat and the taper disappears. As a practical consideration, the taper angle is measured from the top surface of the metal pattern and the upper limit of the taper is about 150°. That is, the taper angle describes a metal pattern having a trapezoidal configuration.

The Examiner rejects claims 3 and 6 as not clearly setting forth the process steps. However, claims 3 and 6 as amended are clear.

As a result, the claims are clear, definite and have full antecedent basis. Accordingly, this rejection is overcome and withdrawal thereof is respectfully requested.

Rejections Under 35 U.S.C. 103(a) Based Upon Hong

Claims 1, 2, 4, 5 and 7-11 are rejected under 35 U.S.C. §103(a) as being obvious over Hong (U.S. Patent 6,172,733). Claims 3, 6, 9 and 12 are rejected 35 U.S.C. §103(a) as being obvious over Hong (as applied to claims 1, 7 and 11) in view of Hwang (U.S. Patent 5,852,481). Applicant traverses.

The present invention pertains to an array substrate and a method for manufacturing an array substrate, which includes forming an electrode line on a substrate by using a wet etching technique. Then, an organic insulating layer is formed on an exposed surface of the substrate while covering the electrode line. The electrode line has a side portion having an overhang or a taper angle of more than 45° from a top surface of the electrode line. In a preferred embodiment of the invention, the electrode line can have first and second metal layers (claim 3). The first metal layer can be formed from aluminum, copper or their alloys (claim 4). The second metal layer can be formed from chromium, molybdenum, tantalum, tungsten or their alloys (claim 5).

Hong teaches away from the invention.

Figure 5 of Hong (relied upon by the Examiner) shows a gate electrode 111 having a first metal layer 211 over which is a second metal layer 213. Hong at column 6, lines 37-59 describes this structure. Hong at column 6, lines 46-51 states "At this step, the second metal layer 213 and the first metal layer 211 are wet-etched to form the gate elements . . . **so that the width of the second metal layer 213 is smaller than the width of the first metal layer 211.** (emphasis added) In contrast Figure 4A of the invention shows the width of the second metal layer 52 wider (overhanging) than the first metal layer 50. That is, Hong teaches away from the invention. Additionally, Hong selects the metals for low and high

melting point, but the invention selects metals for their different resistance to etchants.

As a result, Hong clearly teaches away from the invention and a person having ordinary skill in the art would not be motivated to use any of the teachings of Hong in an attempt to produce a claimed embodiment of the invention. Thus, a *prima facie* case of obviousness has not been made over independent claims 1 and 7. Claims dependent upon these independent claims are patentable for at least the above reasons alone.

Hwang fails to address the above-discussed deficiencies of Hong. As a result, the combination of Hwang with Hong would fail to motivate a person having ordinary skill in the art to produce an embodiment of the invention such as is set forth in claims 3, 6, 9, and 12. Thus, a *prima facie* case of obviousness has not been made over the combination of Hong and Hwang.

Accordingly, these rejections are overcome and withdrawal thereof is respectfully requested.

Prior Art Made of Record and Not Relied Upon by the Examiner

The prior art made of record and not relied upon by the Examiner is indicative of the conventional art which the invention supercedes. Accordingly, no additional remarks are necessary.

Conclusion

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert E. Goozner, Ph.D. (Reg. No. 42,593) at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

Attached hereto is a marked-up version of the changes made to the application by this Amendment.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment: Version with Markings to Show Changes Made

(Rev. 02/20/02)

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The paragraph beginning on page 5, line 12, has been amended as follows:

The electrode line may have first and second metal layers of a dual-layered structure, and a side portion of the first metal layer is [over] more etched than that of the second metal layer. The first metal layer is made of one of aluminum, an aluminum alloy, AlNd, copper and a copper alloy, and the second metal layer is made of one of Cr, Cr-alloy, Mo, Mo-alloy, Ta, Ta-alloy, W, and W-alloy.

The paragraph beginning on page 5, line 17, has been amended as follows:

The electrode line may have first, second and third metal layers of a three-layered structure, and a side portion of the second metal layer is [over etched than] less etched to protrude beyond that of the first and third metal layers.

The paragraph beginning on page 6, line 19, has been amended as follows:

Figs. 4A and 4B are cross-sectional views illustrating a method of forming an electrode line 51 and an insulating layer 54. First, as shown in Fig. 4A, first and second metal layers 50 and 52 are sequentially deposited on a substrate 1 and then are patterned into

a wire electrode [52] 51 of a dual-layered structure. The first metal layer 50 is made of a low resistive metal such as an aluminum-based metal and a copper-based metal. The second metal layer 52 is made of a material having a high corrosion resistance, for example, Cr, Mo, Ta, W, or their alloy.

The paragraph beginning on page 7, line 7, has been amended as follows:

The electrode line 51 has an overhang portion due to a difference of an etching rate between the first and second metal layers 50 and 52. In the conventional art, in order to remove the overhang portion, the dry-etching process is additionally performed. In order to insulate the electrode line, an inorganic insulating layer made of SiNx or [SiO2] SiO_2 is formed. However, in the preferred embodiment of the present invention, in order to insulate the electrode line 51 having the overhang portion, an organic insulating layer 54 is applied using a coating technique, and therefore it is easy to form the organic insulating layer 54 compared with the conventional art using a vacuum deposition technique. Further, since the organic insulating layer 54 is excellent in flatness and has a dielectric constant of less than 3(three), there is an advantage that an aperture ratio of a liquid crystal display device can be improved.

The paragraph beginning on page 8, line 3, has been amended as follows:

--Fig. 5 is a cross-sectional view illustrating a method of forming an organic insulating layer when a wire electrode of a three-layered structure is formed according to the preferred embodiment of the present invention. As shown in Fig. 5, a first metal layer 60 is formed on a substrate 1, and a second metal layer 62 is formed on the first metal layer 60. Further, a third metal layer 64 is formed on the second metal layer 62. An organic insulating layer 54 is formed over the whole surface of the substrate 1 while covering the first, second and third metal layers 60, 62 and 64. The first and third metal layers 60 and 64 is made of a [material having a high corrosion resistance, for example, Cr, Mo, Ta, W, or their alloy] low resistive material such as an aluminum-based metal or a copper-based metal. The second metal layer 62 is made of a [low resistive material such as an aluminum-based metal and a copper-based metal] material having high corrosion resistance such as Cr, Mo, Ta, W, or their alloys.--

The paragraph beginning on page 8, line 22, has been amended as follows:

Even though not shown, the organic insulating layer according to the preferred embodiment of the present invention can be applied to a method of manufacturing an electrode line having no overhang but a taper [angel] angle of more than [45°C] 45° from a top surface of the electrode line. In other words, when the electrode line is a single-layered structure and has a taper angle of more than 45°[C],

it is preferable that the organic insulating layer is formed as an insulating layer for insulating the electrode line. Therefore, defects such as a line open can be prevented.

IN THE CLAIMS:

The claims have been amended as follows:

1. (Amended) A method of manufacturing an array substrate, comprising:

forming an electrode line on a substrate using a wet etching technique; and

forming an organic insulating layer on an exposed surface of the substrate while covering the electrode line,

wherein the electrode line has a side portion having an overhang or a taper angle of more than [45°C] 45° from a top surface of the electrode line.

3. (Amended) The method of claim 1, wherein the electrode line has first and second metal layers of a dual-layered structure, and a side portion of the first metal layer is [over] more etched than [that] a side portion of the second metal layer.

4. (Amended) The method of claim 3, wherein the first metal layer is made of one of aluminum, an aluminum alloy, AlNd, copper [and] or a copper alloy.

5. (Amended) The method of claim 3, wherein the second metal layer is made of one of Cr, Cr-alloy, Mo, Mo-alloy, Ta, Ta-alloy, W, [and] or W-alloy.

6. (Amended) The method of claim 1, wherein the electrode line has first, second and third metal layers of a three-layered structure, and a side portion of the second metal layer is [over] less etched than that of the first and third metal layers.

7. (Amended) An array substrate for a liquid crystal display device, comprising:

an electrode line formed on a substrate; and

an organic insulating layer formed on an exposed surface of the substrate while covering the electrode line,

wherein the electrode line has an overhang or a taper angle of a side portion of the electrode line is more than [45°C] 45° from a top surface of the electrode line.

9. (Amended) The array substrate of claim 7, wherein the electrode line has first and second metal layers of a dual-layered

structure, and a side portion of the first metal layer is [over] more etched than that of the second metal layer.

10. (Amended) The array substrate of claim 9, wherein the first metal layer is made of one of aluminum, an aluminum alloy, AlNd, copper [and] or a copper alloy.

11. (Amended) The array substrate of claim 9, wherein the second metal layer is made of one of Cr, Cr-alloy, Mo, Mo-alloy, Ta, Ta-alloy, W, [and] or W-alloy.

12. (Amended) The array substrate of claim 11, wherein the electrode line has first, second and third metal layers of a three-layered structure, and a side portion of the second metal layer [is over etched than that] protrudes beyond side portions of the first and third metal layers.